UNIWERSYTET GDAŃSKI

Course title
Wykład monograficzny – Fizykochemia związków kompleksowych / Monographic lecture – Physico chemistry of complex compounds

ECTS code
13.3.1106

Name of unit administrating study
Faculty of Chemistry

Studies

Field of study	Type	Form	
Chemical business	Master	Full-time studies	

Teaching staff
Prof. dr hab. inż. Lech Chmurzyński

Forms of classes, the realization and number of hours

A. Forms of classes, in accordance with the UG Rector's regulations
Lecture

B. The realization of activities
classes in classrooms

Number of hours
30

ECTS credits

Lecture: 30 hours
consultations: 10 hours
student's own work : 35 hours
Total: 75 hours - 3 ECTS

The academic cycle
2021/2022 winter semester

Type of course
obligatory

Language of instruction
Polish

Teaching methods
Lecture with multimedia presentation
Lecture – case-studies

Form and method of assessment and basic criteria for evaluation or examination requirements

A. Final evaluation, in accordance with the UG study regulations
Graded assignment

B. Assessment methods
Mid-term tests;
Project or presentation

C. The basic criteria for evaluation or exam requirements

positive assessment of tests covering the subject of the monographic lecture

Required courses and introductory requirements

Formal requirements general chemistry, inorganic chemistry, analytical chemistry, physical chemistry, organic chemistry, coordination chemistry, quantum chemistry

A. Prerequisites

Completed courses in the field of: general chemistry, inorganic chemistry, analytical chemistry, physical chemistry, organic chemistry, coordination chemistry, quantum chemistry; knowledge of the basic issues of general chemistry, inorganic chemistry, analytical and coordination chemistry; knowledge of instrumental methods serving for characterization of chemical compounds; knowledge of and ability to use computer programs: Microsoft Office, and Chem Office.

Aims of education

- presentation of the development of the physical and chemical methods used in studies of solid and liquid phases over the last century,
- introduction to basic instrumental methods used for characterization of chemical substances in the experimental stud-ies;
- presentation of the diversity of scientific projects carry out in the Department of General and Inorganic Chemistry;

- achievement of ability to solve scientific problems and do experimental work independently, according to the synthesis of inorganic and organic systems;
- preparation for selection of the proper scientific literature for writing the Master thesis, M.Sc. thesis

Course contents

Application of the STA-DSC-MS and STA-FTIR methods in chemistry of the coordination compounds (description of the measuring equipment: TG-DSC-MS and STA-FTIR, methods of presentation and interpretation of results); the influence of the various issue (factors) on the results of measurements of the thermal analysis (analysis of the influence of the type and shape of the melting pot, mass sample, heating rate, the methodology of sample preparation, the atmosphere of the furnace on thermal analysis); evaluation of errors in the case of physical measurements, analysis of the melting point of investigated metals by using DSC methodology: assessment of variations in the measurement result from the arithmetic mean; rating error of a single measurement, evaluation of the arithmetic mean deviation; evaluation of errors in the case of physical quantities measured indirectly; study of the formation of the complexes in solution by calorimetric method; goals and methods of the study of formation of complexes in solution: the practical importance of the chemistry of complex compounds, classical preparative method, disadvantages of the preparative methods, property of the systems and the factors affecting their stability, development of research processes of formation of complexes in solution: discussion on references written by: Abbeg, Bodlander, Ostromyslenski, Job and coworkers, physico-chemical analysis, the thermodynamic characteristics of coordination process: chemical stability of the compound, the thermodynamic parameters of coordination process, the equilibrium in aqueous solutions and their quantitative analysis, constants of the stability and their determination methods, the influence of the various issue on the stability of the coordination compounds, theory of the hard and soft acids and bases (HSAB); carbohydrate ligands (donor groups, the conformation, the steric properties of complexes with the carbohydrate ligands; application of the methods for study of the ion metals and carbohydrates coordination structures); kinetic study of the reaction of hydration of the oxalate ligands and its derivatives induced by Fe3+ ions in the coordination systems with transition metal ions; mechanism non- redox of binding and activation of substrate (exopeptidase, endopeptidase, phosphatase hydrolytic enzymes, enzyme catalysed nucleophilic addition of OH- or H+ groups), kinetic study of the reaction of isomerization trans → cis of transition metal ions. Kinetic studies of carbon dioxide capturing reaction by using metal Cr (III) and Co (III) ions connection method. Interactions of the Cr (III) ion with the cell components.

Bibliography of literature

- **Literature required to pass the course**

A.1. Literature used during classes:
A. Bielański – Podstawy chemii nieorganicznej
J. D. Lee – Zwięzła chemia nieorganiczna
P. Pauling, P. Pauling – Chemia
G. Griffin – Research methods for English studies
L. Arnaut, S. Formoshino, H. Burrows – Chemical kinetics from molecular structure to chemical reactivity
R. J. Willson – Isothermal microcalorimetry: theoretical development and experimental studies
A.2. Literature for individual studies:
J. Inczedy – Równowagi kompleksowania w chemii analitycznej
A. Hulanicki – Reakcje kwasów i zasad w chemii analitycznej
H. S. Rossotti, F.J.C. Rossotti – Równowagi jonowe
F. A. Cotton, G. Wilkinson, P.L. Gaus – Chemia nieorganiczna.Podstawy
A. Bartecki – Barwa związków metali
A. Frost, R. Pearson – Kinetics and mechanism

- **B. Extracurricular readings**

A. Bartecki – Chemia pierwiastków przejściowych
S.F.A Kettle – Fizyczna chemia nieorganiczna na przykładzie chemii koordynacyjnej
J. Polster, H. Lachmann – Spectrometric titrantions: analysis of chemical equlibria

Knowledge

Student:
- can apply the STA-DSC-MS and STA-FTIR methods in relation to the chemistry of coordination compounds;
- knows the influence of various factors on the results of measurements in thermal analysis;
- knows how to assess errors in the case of direct measurements of physical quantities;
- knows how to describe the energy effects accompanying the reactions of the formation and disintegration of coordination compounds;
- knows how to define and characterize carbohydrates as complex-forming ligands;
- characterizes and understands stoichiometry of acid-base equilibria, stability reactions occurring in aqueous solutions of transition metal complexes;
- understands the course and description of kinetic processes of isomerization reactions of complexes, hydration reactions of oxalate ions and their derivatives induced by Fe (III) ions;
- explains the reaction kinetics studies uptake of carbon dioxide by coordinating metal ions Cr3 + and Co3 +.

Social competence

The student interprets the results of research obtained while performing the master's thesis; shows connections between the research topic and life, the application of compounds obtained in the course of research: complex transition metal ions, peptides; discusses potential economic utility as a result of his scientific work; appreciates and promotes science and research topics implemented in the Department of General and Inorganic Chemistry.